



SN/TDRSS RANGE SAFETY APPLICATION



SN/TDRSS Support for Range Safety Overview Team Kick-Off Meeting

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SN/TDRSS RANGE SAFETY APPLICATION



AGENDA

- PURPOSE OF THIS MEETING
- THE CONCEPT: SN/TDRSS SUPPORT FOR RANGE SAFETY
- BRIEF HISTORY OF EVENTS
- POINTS OF CONTACT
- CURRENT STATUS
- WHERE TO FROM HERE
- CONCLUSION



SN/TDRSS RANGE SAFETY APPLICATION



PURPOSE OF THIS MEETING

- Gather a team of **EXPERTS** to further assess and study SN/TDRSS support for Range Safety. The effort is growing in visibility/scope and nearing Test Activities.
- Introduce the **CONCEPT** of SN/TDRSS Support for Range Safety (copy of Whitepaper and SN Support for Range Safety Concept and Feasibility Study)
- Define the **GOALS** of the team of experts
 - Evaluate the potential of the SN/TDRSS providing support to ELV Range Safety Command Destruct
 - Refine the GSFC SN Support for Range Safety Concept and Feasibility Study developed by LM GSFC Code 451
 - Support potential TDRSS Range Safety Proof of Concept initiative



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THE CONCEPT: SN/TDRSS SUPPORT FOR RANGE SAFETY

- In general, the **CONCEPT** involves services for launches from the Eastern Range and Western Range :
 - TDRSS S-Band Command Destruct
 - Range Safety Telemetry



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THE CONCEPT: SN/TDRSS SUPPORT FOR RANGE SAFETY

- Why SN/TDRSS Support for Range Safety?
 - Cost of the Current Range Safety Systems/Methods
 - » Number of Down Range Sites
 - » Operations and Maintenance
 - Doing More With Less Funding and Resources
 - » NASA and DOD Budget Constraints
 - » Station Closures
 - » Personnel Reduction
 - » Increased Number of Launches per Year
 - » More Coverage for Less Cost



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THE CONCEPT: SN/TDRSS SUPPORT FOR RANGE SAFETY

- Why SN/TDRSS Support for Range Safety? (cont'd)
 - Technological Advancements
 - » 1960's Technology in a 21 Century Environment
 - » Higher Performing Equipment (Receivers, Interfaces, etc.)
 - USAF Push for System Upgrades (Space-Based Platform Services)
 - » Range Standardization and Automation (RSA) II Phase A
 - » Letters from the USAF
 - » Frequency Issues (RS to Retain UHF??)
 - » Foreign Policies



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THE CONCEPT: SN/TDRSS SUPPORT FOR RANGE SAFETY

- Operational Scenarios
 - Transition from UHF System to S-Band System (Ground and Launch Vehicle)
 - Eliminate Down Range Stations and provide Continuous Coverage through All Launch Phases
 - SN/TDRSS Role Primarily to Supplement the Launch Head with S-Band Down Range Support - “Seamless” Transition
 - Launch Head and TDRSS Radiate PN Spread signals
 - » RS Receiver track both signals
- Is a standard TDRSS signal, non-spread, or GN Mode more advantageous?
 - Link Margins
 - Acquisition time



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THE CONCEPT: SN/TDRSS SUPPORT FOR RANGE SAFETY

- Assessed Areas that May Require Refinement
 - Link Margin. Static CLASS Analysis Forward Link - 18.8 dB
 - Data Latency. ~350ms (terrestrial thru GSFC)
 - Data Security. Diverse routing, encrypted at ROCC
 - RFI (Anti-Jamming). PN Spread Signal
 - LV Equipment. Multi-channel S-Band Receiver, Antenna Positioning
 - TDRSS Shuttle Hi Power. Waiver from NTIA required
 - Cost. Estimates imply significant cost savings (Millions of Dollars). Operations and Maintenance reductions.



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THE CONCEPT: SN/TDRSS SUPPORT FOR RANGE SAFETY

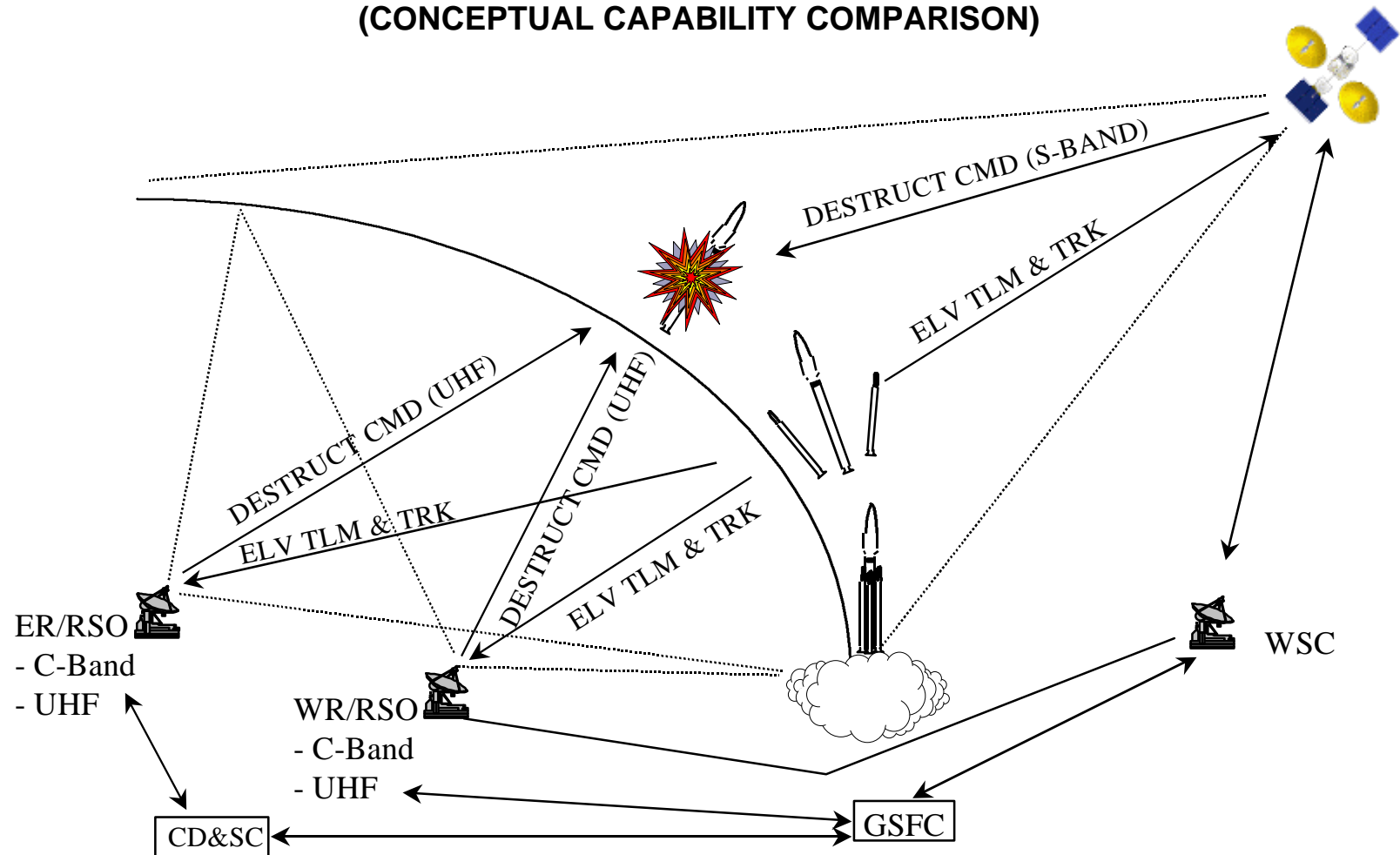
- Several Technical Challenges have been Identified and Need Further Investigation
 - Verify TDRSS telemetry Identical to Ground Station Telemetry.
 - Measured Actual Data Latency is less than 500 milliseconds
 - Mitigating Multipathing from Liftoff through First Stage Flight
 - TDRSS has no Experience with the LV Command Destruct
 - S-Band LV Range Safety Command Destruct Equipment
 - NTIA Waiver for Exceeding PFD Limitations
 - Potential for WSC Modulator Doppler Predictor (MDP) to provide non-spread PM on a sub-carrier
 - Are There More?



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THE CONCEPT: SN/TDRSS SUPPORT FOR RANGE SAFETY (CONCEPTUAL CAPABILITY COMPARISON)

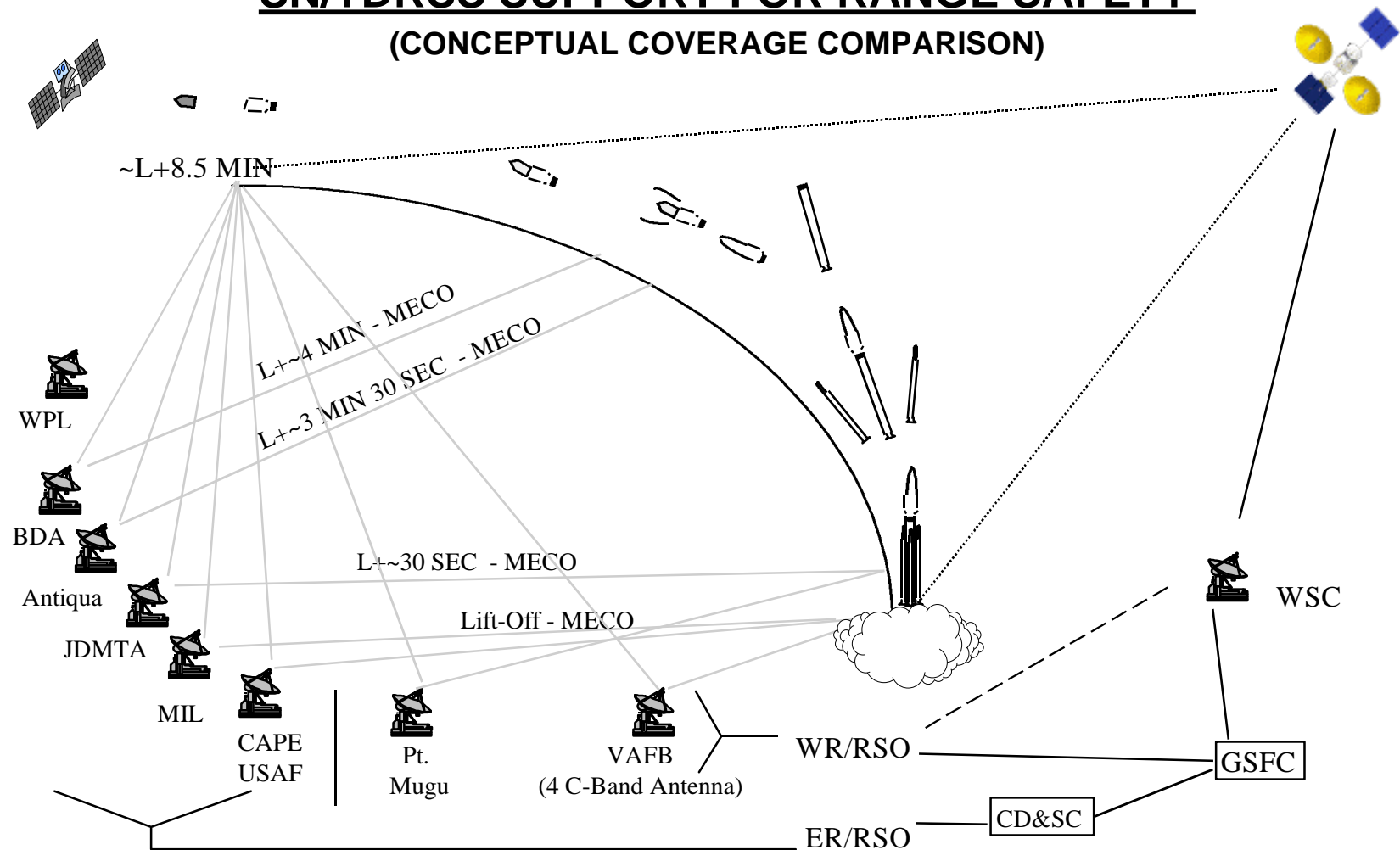




SN/TDRSS RANGE SAFETY APPLICATION



THE CONCEPT: SN/TDRSS SUPPORT FOR RANGE SAFETY (CONCEPTUAL COVERAGE COMPARISON)





SN/TDRSS RANGE SAFETY APPLICATION



BRIEF HISTORY OF EVENTS

- Key Events (June 1996 - December 1997)
 - Second TDRSS Workshop/Range Safety Splinter Group (6/96)
 - NASA HQ Meeting (7/96)
 - Wallops Range Commanders Council/Range Safety Group (10/96 - Turning Point)
 - Eastern Range (ER) USAF Letter Recommending to Examine TDRSS for Range Safety (1/97 - Key Support from USAF)
 - Preliminary Business Case provided to Code 450 (3/97)
 - Code 450 Presentation to SOMO (4/97 - Well Accepted)
 - Nellis AFB Range Commanders Council/Range Safety Group (3/97 - Associate RCC/RSG Members)
 - Telecon with USSPACECOM Kick-Off for Investigating Space-Based Platforms (5/97)
 - Development of Draft GSFC Concept/Feasibility Study (5/97 - Initiated; 1/98 - Limited Distribution; Well Received/Reference in Subsequent Analyses)



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BRIEF HISTORY OF EVENTS

- Products
 - Presentations - RCC/RSG, GSFC Network Management, SOMO (10/96, 1/97, 3/97, 4/97)
 - Tactical Guidelines Document (12/96)
 - Preliminary Business Case (3/97)
 - SN Support for Range Safety Concept and Feasibility Study (12/97)
 - Whitepaper: SN Support for Range Safety Concept and Feasibility (5/98)
- Range Community Feedback on ALL ASPECTS of this Activity are EXTREMELY POSITIVE (as opposed to when this effort was initiated)



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POINTS OF CONTACT

- Material Not Developed In A Closed Box
- Open Communications with Various Organizations
 - NASA GSFC Management
 - Range Commanders Council/Range Safety Group
 - Eastern Range (ER) - strong advocates
 - The Aerospace Corporation (Western Range - WR)
 - US Space Command
 - ACTA (space-based requirements)
 - LM/WR RSA II Team (Study of Several Space-Based Platforms)
 - Various Vendors



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CURRENT STATUS

- Most Recent Events
 - Letter from USSPACECOM to USAF Chief of Staff at the Pentagon stating
“To complete our (USAF) vision, we’ll need a space-based communications network and a command destruct system that employs this network.”
 - 35th Space Congress
 - » Command and Control Through Space-Based Systems
 - » Eastern Range To-Date Experiences with TDRSS and Potential Future Uses
- Most Recent Developments
 - The “Magic Box” - LV Equipment with TDRSS Compatible Components and GPS in one box.
 - Telecon with USPACECOM, ER, WR, Florida Spaceport - very strong support to pursue Proof of Concept Test Program for the “Magic Box”
 - ER adamantly stating the desire for GSFC to be Lead Entity - DECISION POINT



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WHERE TO FROM HERE

- Baseline the SN Support for Range Safety Concept and Feasibility Study with GSFC Team Input. Update Whitepaper accordingly.
- Work with ER to Prepare Presentation for “Road Show” of the Concept
- Decision Point for NASA GSFC Management
 - Lead the Team (GSFC, ER, WR, USSPACECOM)
 - Provide Services
 - Support Proof of Concept
- Proposed Team Initiatives
 - Space-Based Platform Requirements Analysis
 - CLASS/CAGE Analyses
 - LV Transceiver Specs
 - Operational Scenarios
 - Loading Analyses
 - Proof of Concept Activities



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CONCLUSION

- Small Team of Gov't Agencies/Contractors Involved to Maintain Control
- Overwhelming Support for a Space-Based Platform to provided Range Safety Service, TDRSS Focal Point
 - Members of the Range Community (Eastern Range, US Space Command)
 - Political Space Entities (Spaceport Florida)
 - Industry (LV Equipment Vendors)
- The Time is NOW!